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CRANE TRUCK, WAREHOUSE

Army Test and Evaluation Command  
Aberdeen Proving Ground, Maryland

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## 13. ABSTRACT

Provides a system for evaluation of warehouse crane truck performance characteristics. Discusses test planning and preliminary requirements for initial inspection, physical characteristics, servicing, training, safety precautions, run-in operation, and facilities; Lists references for performance tests of clutch pedal, steering wheel, service brake, towing hook, load line hook, boom topping, sluing, crane speed, acceleration acceleration response, slope ascension, parking brake, underclearance, stopping distance, stability, lifting attachments, structural load and overloads, turning radius, power train static torque, controls, hook and cable; for post-test maintenance and inspections; and for endurance, transportability,, maintenance, safety, and human factors evaluations. Discusses reliability. Applies to gasoline-driven and electric cranes. Excludes techniques for some special purpose crane trucks.

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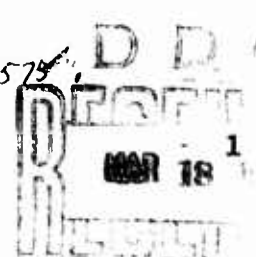
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SECTION I  
GENERAL

1. Purpose and Scope. This TOP provides guidance for planning tests of warehouse crane trucks to assure their conformance with required operational capabilities (ROC's), development plans (DP's), or other governing documents. Subtests suitable for meeting the requirements of development tests (DT) I, II (ET), or III or other customer-sponsored tests can be selected from those listed in section II. For a DT II (ET) the scope will be dependent on the criteria of the governing ROC or DP. For a DT III preproduction or initial production test the scope will be in accordance with the contractual provisions of the applicable military specifications and suitability criteria as established by the test directive. Environmental testing, as dictated by the size and nature of the test item, may require a combination of

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chamber testing and on-site climatic tests. This procedure is a basic guide and may not include techniques required for some special purpose warehouse crane trucks.

## 2. Background.

a. Description. The warehouse crane is a self-propelled vehicle consisting of a boom mounted on a mobile, wheeled chassis. It is designed to operate in limited spaces to lift, transport, and deposit materials that cannot be readily handled by other types of materials handling equipment. The vehicle may be equipped with either solid rubber or pneumatic tires, depending upon its intended application. Those employing solid rubber tires are normally used for materiel movement in indoor storage, while those using pneumatic tires may be used for outdoor or indoor operations but are particularly adaptable to outdoor or shed storage. The warehouse crane is manufactured in two types - the fixed boom and the sluing boom; the sluing boom type, however, is the only model currently available for use by the Army. The sluing boom type is a specially designed, self-propelled vehicle that may be called a crane truck. The boom and hoisting unit are mounted so that they may be swung without moving the crane chassis. Most of the load is supported by the drive wheels, and the engine is placed in the rear of the unit to serve as part of the counterweight.

b. Motive Power. The warehouse crane may be powered by a gasoline engine or a battery-driven electric motor. The engine-powered warehouse crane is designed to operate at least an 8-hour shift before refueling is required. It may be equipped with either solid rubber or pneumatic tires and usually has a capacity of from 6,000 to 10,000 pounds. The battery-driven electric motor unit is equipped with solid rubber tires and normally has a capacity of 6,000 pounds.

c. Application. The warehouse crane is particularly useful in handling loads with shapes and sizes difficult for other types of materials handling equipment to manage. It can be used to reach loads in places inaccessible to other types of equipment and to supplement facilities offered by fixed or overhead cranes. For movements over 400 feet, the tractor-trailer train or the straddle truck should usually be used to transport the materials lifted and deposited by cranes. It may be necessary to use forklift trucks, particularly in warehouse operations, to build piles or stacks with the loads deposited by cranes or to top off stacks after cranes have stacked them to the limit of boomhead space.

d. Test Specifications and Standards. Warehouse crane testing is conducted basically in accordance with the requirements and procedures described in MIL-C-3998 and MIL-STD-00261B for gasoline-powered items; or MIL-C-3988 and MIL-STD-262 for battery-powered items. Test procedures presented in these documents may be supplemented or modified as prescribed by the test directive or as described herein.

3. Equipment and Facilities. The required equipment and facilities are described in the publications referenced in sections II and III.

SECTION II  
TEST PROCEDURES

4. Supporting Tests. Subtests (in preferred order of completion with respect to high-risk, short-duration) to be considered in formulating a test plan are listed below with applicable TOP's/MTP's, military standards, and other references. Paragraph 4.1 applies to gasoline-driven cranes and paragraph 4.2 is for the electric crane.

4.1 Crane Truck, Warehouse, Gasoline, Pneumatic Rubber Tires.

<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
a. Preliminary Activities (refer to para 6)	
(1) Initial Inspection	1-2-504, 2-2-502; MIL-STD-00261B, Pretest Inspection Checklist
(2) Training and Familiarization	10-2-501
(3) Maintenance Service and Inspection	MIL-STD-00261B, pp. 12 and 13 and portions of pp. 8-11
(4) Run-In (refer to para 7)	
b. Technical Performance	MIL-STD-00261B:
(1) Clutch Pedal	Test Form 1
(2) Steering Wheel	Test Form 2
(3) Service Brake Pressure Sensitivity, Towing Hook Strength	Test Form 3
(4) Service Brake Pressure	Test Form 4
(5) Load Line Hook, Boom Topping, and Sluing Speed	Test Form 5
(6) Speed	Test Form 6
(7) Acceleration, Acceleration Response	Test Form 7
(8) Slope Ascension, Parking Brake, Underclearance	Test Form 8

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<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
( 9) Stopping Distance	Test Form 9
(10) Stability	Test Form 10
(11) Lifting Attachments	Test Form 11
(12) Wear of Steering Mechanism	Test Form 12
(13) Structural Load and Overloads	Test Form 13
(14) Turning Radius, Travel Capacity	Test Form 14
(15) Power Train Static Torque Test	Test Form 15
(16) Controls	Test Form 16
(17) Hook and Cable	Test Form 17
c. Endurance Test	MIL-STD-00261B, paras 5.2.1-5.2.11; pp. 12 and 13
d. Post-Test Activities	MIL-STD-00261B:
(1) Maintenance Service and Inspection	Pp. 12 and 13
(2) Post-Test Inspection Test Checksheet	P. 41
(3) Post-Test Inspection Form	Pp. 42 and 43
e. Operational Performance (refer to para 8)	
f. Transportability	1-2-500
g. Reliability (refer to para 9)	
h. Maintenance Evaluation (refer to para 9)	1-2-501, TECR 750-15
i. Safety Evaluation	2-2-508, 10-2-508, and portions of MIL-STD- 00261B
j. Human Factors	10-2-505

**4.2 Crane Truck, Warehouse, Electric, Solid Rubber Tires.**

<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
<b>a. Preliminary Activities (refer to para 6)</b>	
(1) Initial Inspection	1-2-504, 2-2-502; MIL-STD-262, Pretest Inspection Checklist
(2) Training and Familiarization	10-2-501
(3) Maintenance Service and Inspection	Vehicle manual and MIL-STD-262, pp. 7-15
(4) Run-In (refer to para 7)	
<b>b. Technical Performance</b>	MIL-STD-262:
(1) Steering Wheel	Test Form 2G
(2) Towing Hooks	Test Form 5G
(3) Speed	Test Form 7G
(4) Slope Ascension	Test Form 8G
(5) Stability	Test Form 14G
(6) Wear of Steering Mechanism	Test Form 15G
(7) Acceleration	Test Form 16G
(8) Stopping Distance	Test Form 17G
<b>c. Endurance Test</b>	MIL-STD-262, paras 5.2.1-5.2.2.6
<b>d. Post-Test Activities</b>	
(1) Maintenance Service and Inspection (as required)	Vehicle manual
(2) Post-Test Inspection Test Check- sheet	MIL-STD-262, p. 37
(3) Post-Test Inspection Form	MIL-STD-262, pp. 38-41
<b>e. Operational Performance (refer to para 8)</b>	



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<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
f. Transportability	1-2-500
g. Reliability (refer to para 9)	
h. Maintenance Evaluation (refer to para 9)	1-2-501, TECR 750-15
i. Safety Evaluation	2-2-508, 10-2-508, and portions of MIL- STD-262
j. Human Factors	10-2-505

### SECTION III SUPPLEMENTARY INSTRUCTIONS

5. Test Planning. Engineering test planning requires review of test guidance literature; familiarity with preceding development and test phases; study of test criteria; and selection of appropriate samples, methods, sequence, facilities, and test equipment. Risk, cost, and safety provisions must be given prime consideration. Data from previous and similar tests should be considered in order to avoid duplication and to reduce the scope of future testing.

The type and scope of test are determined from the test directive. Depending on the number of samples available, the specific subtests and sequence of accomplishment are established. It is usually desirable to have at least three test samples: one for conducting the transportability, simulated maintenance, and human factors subtests and two for running the endurance test concurrently with the other subtests. The number of samples available will affect the test sequence.

#### 6. Preliminary Activities.

a. Facilities and Support. The test course is adjusted to insure that loads, aisles, and lift stations comply for the size and type of cranes to be tested (see Dwgs. E-4, F, and G in MIL-STD-262 and figs. 1, 2, and 3 in MIL-STD-00261B). The test schedules, shift operation, scheduled maintenance, and logistic support are considered and arranged in the overall framework of available time and resources.

b. Test Item. The test item is inspected, inventoried, depreserved, and serviced, and physical characteristics are determined in accordance with TOP 1-2-504 and TOP/MTP 2-2-502. The inspections required by MIL-STD-00261B or MIL-STD-262 are also conducted when specified.

c. **Personnel.** Test personnel are instructed with appropriate lectures and on-the-job training on the test item in accordance with the applicable procedures of TOP/MTP 10-2-501. Training includes supervised driving of the test item on the test course until proficiency in crane handling and course negotiation is demonstrated. All aspects of safety awareness are emphasized. Adequacy of technical manuals for the purpose of training is assessed at this time.

7. **Run-In.** A run-in period of operation is required when the test item has not experienced operating time. The purpose of the run-in period is to discover those failures considered to be a result of infant mortality (failures not truly representative of the item). This may be accomplished during the training and familiarization operation.

8. **Operational Performance.** The performance of the crane is determined by its ability to lift, maneuver, and move cargo in and around warehouse loading platforms and docks. It may be operated on paved and semi-prepared surfaces for short distances. This test is conducted to determine whether the item is capable of performing its intended function.

9. **Reliability.** Data for the reliability subtest (and for most of the maintenance evaluation as well) will be obtained during the endurance test described in MIL-STD-00261B or MIL-STD-262, as applicable. If the reliability required by the directive or contract cannot be determined within the duration of the standard endurance test, the number of test course circuits are appropriately increased. This is also the case with maintenance factors, such as mean time between failure. Failures are assumed to be exponentially distributed (see MIL-STD-781B), but the advice of statisticians who are aware of current policies should be obtained when formulating a reliability subtest.

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APPENDIX  
REFERENCES

1. TECR 750-15, "Maintenance Evaluation During Testing," 1 December 1969.
2. TM 10-1619, "Quartermaster Materials Handling Equipment," 25 March 1963.
3. MIL-STD-00261B, "Test and Inspection of Crane Truck, Warehouse, Gasoline, Pneumatic Rubber Tires," 29 April 1965.
4. MIL-STD-262, "Test and Inspection of Crane Truck, Warehouse, Electric, Solid Rubber Tires," 11 March 1957.
5. MIL-STD-781B, "Reliability Tests: Exponential Distribution," 15 November 1967.
6. MIL-C-3988, "Crane, Truck, Warehouse, Electric, Solid Rubber Tires," 26 December 1956.
7. MIL-C-3998B, "Crane Trucks, Warehouse, Gasoline or Diesel Engine, Pneumatic Rubber Tires," 29 July 1969.